REMARKS

Claims 1-73 have been examined in this application and currently rejected to by the Examiner. Claim 17 is objected to because the Examiner states it should depend on claim 15. Claims 1-5, 11, 12, 21, 23-26, 28, 29, 31, 34, 42, 47-54, 56, 57, 61-64, 68 and 73 are rejected under 35 USC 102(b) as being anticipated by Ruha (U.S. Patent 6,466,087). Claims 6-7, 8-10, 13, 14, 15-20, 22, 27, 30, 31, 32, 33, 35, 36-41, 43-44, 45, 46, 55, 58-60, 65-67, 69, 70 and 71 are rejected under 35 USC 103(a) as being unpatentable in view of prior art.

Claims 74-85 have been added by amendment.

Objection to Claim 17

The Examiner objects to **Claim 17,** as Claim 17 should apparently depend from claim 15. Applicants have amended it accordingly and thank the Examiner for his careful review of the claim dependencies.

Rejection Under 35 U.S.C. § 102(b) of Claims 1-5, 11, 12, 21, 23-26,28, 29, 31, 34, 42, 47-54, 56, 57, 61-64, 68 and 73

The Examiner rejects **claims 1-5, 11, 12, 21, 23-26,28, 29, 31, 34, 42, 47-54, 56, 57, 61-64, 68 and 73** under 35 U.S.C. § 102(b) as anticipated by Ruha (U.S. Patent 6,566,087). Claim 47 is cancelled. In this section, we address the independent claims 1, 23, 24, 48, 49 and 68 and a handful of selected dependent claims, particularly claims 42, 64 and 61. The remaining dependent claims are allowable for at least the same reasons as the independent claims.

Claims 1, 23 and 24

Independent claims 1, 23 and 24 include limitations such as:

> *a digital filter configured to receive an output of said pulse width modulator, wherein said output comprises a distortion, and wherein said digital filter samples said output at said clock rate to suppress said distortion*

These limitations are not found in Ruha, as Ruha treats the output of the pulse width modulator as an ideal reference signal, without recognizing distortion in the PWM output or attempting to correct distortion in that output. From Ruha col. 5, lines 35-44:

> In greater detail, the filter 16A of FIG. 6B operates to measure the short-term averaged difference between the reference PWM signal and the actual

> output signal of the switching stage 14. The ***reference PWM signal output from the PWM modulator 12 is assumed to be ideal***, and is further assumed to be generated ***from a clean and well-regulated power supply***. This latter assumption is feasible to realize, as the actual power taken from the power supply that powers the PWM modulator 12 is relatively low.

The result that Ruha teaches, using the PWM output as an ideal reference, is to match the output of the power stage to the PWM output, at col. 6, lines 58-62:

> The ***overall result*** of this feedback/correction mechanism is an attempt to ***adjust the pulse width*** (area) of 60 the PWM signal ***output from the power stage*** 15 to be ***equal to the area of the ideal PWM signal output from the PWM block*** 12.

Ruha cannot be shown to meet the claimed limitations.

Therefore, claims 1, 23 and 24 should be allowable over Ruha. So to should dependent claims 2-22 and 25-42 be allowable, as they depend from allowable independent claims.

Claim 48

Independent claim 48 includes the limitations:

> *An integrated circuit chip configured to receive a pulse code modulated digital signal and to generate a pulse width modulated digital output signal, wherein said output signal has a distortion, and wherein said distortion is suppressed by a digital filter that operates at at least a clock rate of said pulse width modulated digital signal.*

These limitations are not found in Ruha. As described above, Ruha treats the output of the pulse width modulator as an ideal reference signal, without recognizing distortion in the PWM output or attempting to correct distortion in that output. Col. 5, lines 35-44.

Therefore, claim 48 should be allowable over Ruha.

Claims 49 and 68

Independent claims 49 and 68 include the limitations:

> *(49) modulating said second pulse code modulated signal into a third signal comprising a plurality of pulses in time having a clock rate; and*
>
> *filtering in a digital domain said plurality of pulses in time to suppress a distortion in said third signal*
>
> *(69) means for modulating said second pulse code modulated signal into a third signal comprising a plurality of pulses in time having a clock rate; and*
>
> *means for filtering in a digital domain said plurality of pulses in time to suppress a distortion in said third signal*

These limitations are not found in Ruha. Once again, Ruha treats the output of the pulse width modulator as an ideal reference signal, without recognizing distortion in the PWM output or attempting to correct distortion in that output. Col. 5, lines 35-44.

Therefore, claims 49 and 68 should be allowable over Ruha.

Claims 42 and 64

Dependent claims 42 and 64 include the limitations:

The digital signal processing circuit of claim 24, wherein said sampling occurs at a clock rate of said pulse width modulator.

The sampling referred to is sampling by the digital filter. This limitation is not found in Ruha, as Ruha's digital filter samples at twice the clock rate of his PWM. Col. 6, lines 49-51. The section of Ruha cited by the Examiner describes operation of the PWM, rather than a digital filter.

Therefore, claims 42 and 64 should be allowable over Ruha.

Claim 61

Claim 61 includes the limitations:

The method of claim 49, wherein said filtering comprises forming a feedback signal having said first resolution.

Addressing this limitation, the Examiner points to the optional feedback loop of Ruha's figure 4, which is described at col. 5, lines 13-20:

> An optional global feedback loop is shown in dashed outline as well in FIG. 4. The optional feedback loop closes the loop from the load 15 back to at least one of the sigma-delta modulator 11 or the PW correction block 13. In this approach the feedback signal is taken from an output terminal of the load 15, *preferably after the LC filter*, and is applied to the controlled component(s).

From figure 2, it can be seen that the *LC filter* mentioned converts the signal format from digital to analog. There is no discussion of how the feedback signal would be applied to the sigma-delta modulator. Neither this description nor what would necessarily be implied by the dashed outline in figure 4 proves anticipation of the limitation.

Therefore, claim 61 should be allowable over Ruha.

Applicant respectfully submits that claims 1, 23, 24, 48, 49, 68, 42, 64, 61 and the claims that depend from them should be allowable over Ruha.

Rejection Under 35 U.S.C. § 103(a) of Claims 22 and 35

The Examiner rejects **claims 22 and 35** under 35 U.S.C. § 103(a) as unpatentable over Ruha (U.S. Patent 6,566,087).

Applicant respectfully submits that claims 22 and 35 should be allowable over Ruha for at least the same reasons as the claims from which they depend.

Rejection Under 35 U.S.C. § 103(a) of Claims 6, 27 and 55

The Examiner rejects **claims 6, 27 and 55** under 35 U.S.C. § 103(a) as unpatentable over Ruha (U.S. Patent 6,566,087) in view of Huang (U.S. Patent Application Pub 2004/0213333).

Applicant respectfully submits that claims 6, 27 and 55 should be allowable over Ruha in view of Huang for at least the same reasons as the claims from which they depend.

Rejection Under 35 U.S.C. § 103(a) of Claims 7, 30, 43, 44, 69 and 70

The Examiner rejects **claims 7, 30, 43, 44, 69 and 70** under 35 U.S.C. § 103(a) as unpatentable over Ruha (U.S. Patent 6,566,087) in view of Groves Jr. (U.S. Patent 6,593,807). We traverse each of the rejections.

Claim 43

Independent claim 43 includes the limitations:

> *a forward path comprising a first filter stage coupled with and upstream from an encoder stage, wherein said encoder stage comprises a first order sigma-delta type modulator and a pulse width modulator, wherein said sigma-delta type modulator generates an oversampled signal having a period and a total number of levels, and said pulse width modulator operates at a clock rate that is at least M times said period, where M is said total number of levels in said oversampled signal, and wherein said forward path produces an output having a distortion; and*
>
> *a feedback path comprising a digital filter that samples said output in a digital domain to suppress said distortion*

These limitations are not found in Ruha in view of Groves Jr. As described above, the Examiner relies on Ruha for filtering and Ruha treats the output of the pulse width modulator as an ideal reference signal, without recognizing distortion in the PWM output or attempting to correct distortion in that output. Col. 5, lines 35-44.

Therefore, claim 43 should be allowable over Ruha in view of Groves Jr.

Moreover, the Examiner relies on Grove Jr. to add a feedback filter upstream of the sigma-delta modulator, referring to the noise shaping filter 2-1 in figure 2:

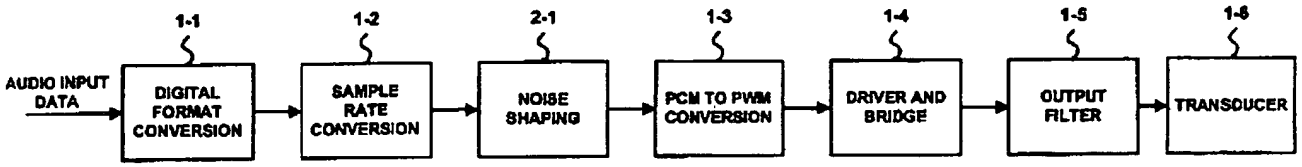

FIG 2: Prior Art

The corresponding description is in col. 1, lines 50-64:

> A second digital-input class D amplifier topology is shown in FIG. 2. This scheme provides limited audio-band resolution and therefore requires a noise-shaping filter (2-1) to approach acceptable audio quality.
>
> The noise-shaping filter reduces the required resolution of the input signal by placing the quantiser in a feedback loop with a digital filter, such that the filter quantisation error is subtracted from subsequent input samples.
>
> However, system complexity and related risks are increased with the addition of a noise-shaping filter. By placing the quantiser in a feedback loop, artifacts such as jitter, quantisation error and stability limit the practical performance. Also, increasing the noise-shaping filter's order beyond three offers diminishing improvements in performance at reasonable oversampling rates.

The noise-shaping filter described here is a sigma-delta type modulator, not a separate filter upstream of a sigma-delta modulator.

The combination of Ruha and Grove Jr. is improper for lack of evidence of motivation, which is clearly required by MPEP § 2143.01, *citing In re Lee*, 277 F.3d 1338, 1342-44 (Fed. Cir. 2002). The Examiner argues, "One of oridnary skill in the art at the time of the invention would have been motivated to add Groves Jr.'s noise shaping filter to improve the audio quality of the signal". OA, at 10. But this is a statement of the supposed *result* of combining the references using the claim as a blueprint (20-20 hindsight), which is impermissible. 2-5 Chisum on Patents § 5.03 [2][c] n. 29 (2005 Lexis version); *e.g. ATD Corp. v. Lydall, Inc.*, 159 F.3d 534, 546, 48 USPQ2d 1321, 1329 (Fed. Cir. 1998) ("Determination of obviousness can not be based on the hindsight combination of components selectively culled from the prior art to fit the parameters of the patented invention."); *Grain Processing Corp. v. American Maize-*

Products Corp., 840 F.2d 902, 907, 5 USPQ2d 1788, 1792 (Fed. Cir. 1988) ("Care must be taken to avoid hindsight reconstruction by using 'the patent in suit as a guide through the maze of prior art references, combining the right references in the right way so as to achieve the result of the claims in suit.' "). We say "supposed" result because adding a non-linear noise shaping component to a circuit with other non-linearities is not as easy as moving blocks around in a diagram. The filter depicted in Grove Jr. is not part of a feedback loop nor does it process output of a pulse width modulator. The Examiner's reference to Groves Jr. Col. 1 is not an evidentiary quality suggestion to use an additional noise shaping filter in a feedback loop that is input to a sigma-delta modulator. Therefore, the combination is improper.

For these additional reasons, claim 43 should be allowable over Ruha in view of Groves Jr.

Claims 7 and 30

Dependent claims 7 and 30 include limitations similar to claim 43:

further comprising a filter upstream of said pulse width modulator

The filter referred to is in addition to an oversampling modulator (see claims 3 and 25). As explained above, Groves Jr. depicts a noise-shaping filter which is a sigma-delta type modulator, not a separate filter upstream of a sigma-delta modulator. Moreover, the combination of Ruha and Grove Jr. is improper for lack of evidence of motivation, where the Examiner uses the claims as a blueprint for combining the references, without the least suggestion in Groves Jr. to use an additional noise shaping filter in a feedback loop that is input to a sigma-delta modulator.

Therefore, claims 7 and 30 should be allowable over Ruha in view of Groves Jr.

Claim 44

Claim 44 includes the limitation, similar to claims 42 and 64:

wherein said digital filter samples said output at said clock rate

This limitation is not found in Ruha, as Ruha's digital filter samples at twice the clock rate of his PWM. Col. 6, lines 49-51. The section of Ruha cited by the Examiner describes operation of the PWM, rather than a digital filter.

Therefore, claim 44 should be allowable over Ruha in view of Groves Jr.

Claims 69 and 70

Claims 69 and 70 include the limitation:

wherein the filter is an integrator

The filter referred to is upstream of the sigma-delta modulator and operates on a signal that corrects distortion in pulse width modulation. *See*, claims 7 & 30. The Examiner's reference to a digital-to-analog conversion filter placed between the power supply and speakers is inapposite.

Therefore, claims 69 and 70 should be allowable over Ruha in view of Groves Jr.

Applicant respectfully submits that claims 43, 7, 30, 44, 69, 70 and claims that depend from them should be allowable over Ruha in view of Groves Jr.

Rejection Under 35 U.S.C. § 103(a) of Claims 8-10 and 58-60

The Examiner rejects **claims 8-10 and 58-60** under 35 U.S.C. § 103(a) as unpatentable over Ruha (U.S. Patent 6,566,087) in view of Lis (U.S. Patent Application Pub 2004/0037432). We traverse each of the rejections.

Claims 8-9 and 58-59

Claims 8-9 and 58-59 include the limitations:

wherein said digital filter comprises an IIR filter

wherein said IIR filter comprises a single pole filter

These limitations are not found in Ruha in view of Lis. The digital filter referred to is useful to correct distortion caused by pulse width modulation. Neither of the references teach that this kind of filter would be useful to correct distortion caused by pulse width modulation. Ruha assumes that the output of his pulse width modulator an ideal reference signal, without recognizing distortion in the PWM output or attempting to correct distortion in that output. Col. 5, lines 35-44. Lis cross-correlates two signals, neither of which is pulse width modulated. *See*, figures 2 & 4.

The Examiner's argument that using a single pole IIR filter "is considered merely as one of several straightforward digital filter possibilities" amounts to a suggestion by the Examiner to try, without any concrete expectation that application of the particular filter would be useful to correct distortion caused by pulse width modulation. It does not meet the standard set by MPEP § 2143.01, *citing In re Lee*.

Therefore, claims 8-9 and 58-59 should be allowable over Ruha in view of Lis.

Claims 10 and 60

Claims 10 and 60 include the limitations:

wherein said digital filter comprises a low pass filter

These limitations are not found in Ruha in view of Lis. Similarly to the IIR filter above, the claimed low pass filter is useful to correct distortion caused by pulse width modulation. Neither of the references teach that this kind of filter would be useful to correct distortion caused by pulse width modulation. Ruha assumes that the output of his pulse width modulator an ideal reference signal, without recognizing distortion in the PWM output or attempting to correct distortion in that output. Col. 5, lines 35-44. Lis cross-correlates two signals, neither of which is pulse width modulated. *See*, figures 2 & 4.

The Examiner's argument that using a low pass, single pole IIR filter "is considered merely as one of several straightforward digital filter possibilities" amounts to a suggestion by the Examiner to try, without any concrete expectation that application of the particular filter would be useful to correct distortion caused by pulse width modulation. It does not meet the standard set by MPEP § 2143.01, *citing In re Lee.*

Therefore, claims 10 and 60 should be allowable over Ruha in view of Lis.

Applicant respectfully submits that claims 8-10 and 58-60 should be allowable over Ruha in view of Lis.

Rejection Under 35 U.S.C. § 103(a) of Claims 13, 14, 31, 32 and 65-67

The Examiner rejects **claims 13, 14, 31, 32 and 65-67** under 35 U.S.C. § 103(a) as unpatentable over Ruha (U.S. Patent 6,566,087) in view of Bedini (U.S. Patent 4,555,795). Applicant respectfully submits that claims 13, 14, 31, 32 and 65-67 should be allowable over Ruha in view of Bedini for at least the same reasons as the claims from which they depend.

Rejection Under 35 U.S.C. § 103(a) of Claim 15-20 and 36-41

The Examiner rejects **claim 15-20 and 36-41** under 35 U.S.C. § 103(a) as unpatentable over Ruha (U.S. Patent 6,566,087) in view of Terui (U.S. Patent 5,903,871).

The combination lacks many elements for which the Examiner is relying on Ruha, as explained above.

The combination is most suspect, especially the motivation to combine. Terui figure 7 depicts a handheld recorder for dictation and playback. One of ordinary skill in the art would be hard-pressed to justify the cost of packing a 100+ dB SNR circuit into a handheld recorder. As above, the Examiner's statement of motivation is a statement of the *result* of combining the references using the claim as a blueprint (20-20 hindsight), which is impermissible. The Examiner makes no effort to find in Terui any suggestion to produce minimal error and distortion, as that is not the nature of Terui's device.

Applicant respectfully submits that claims 15-20 and 36-41 should be allowable over Ruha in view of Terui.

Rejection Under 35 U.S.C. § 103(a) of Claims 45 and 71

The Examiner rejects **claims 45 and 71** under 35 U.S.C. § 103(a) as unpatentable over Ruha (U.S. Patent 6,566,087) in view of Groves Jr. (U.S. Patent 6,593,807) further in view of Izandpanah (U.S. Patent 6,735,398).

The proposed combination does not result in the claimed performance characteristics of the claimed circuit. The Examiner relies on Izandpanah for performance statistics, citing col. 7, lines 11-22. But one cannot simply combine Izandpanah's performance statistics with the other references and argue that the circuits disclosed by the other references perform at Izandpanah's asserted levels. That's like combining a great sport team's win-loss record with a weak sport team's players and arguing that the combination allows the weak team to win the Super Bowl or Stanley Cup.

Applicant respectfully submits that claims 45 and 71 should be allowable over Ruha in view of Groves Jr. and Izandpanah.

Rejection Under 35 U.S.C. § 103(a) of Claims 46 and 72

The Examiner rejects **claims 46 and 72** under 35 U.S.C. § 103(a) as unpatentable over Ruha (U.S. Patent 6,566,087) in view of Groves Jr. (U.S. Patent 6,593,807) further in view of Pennock (U.S. Patent 6,573,850).

This time, the Examiner is trying to attribute "Penncock's noise level" performance statistics to the "Ruha and Groves Jr. combination in order to ensure quality signal transmission." One cannot simply combine Penncock's performance statistics with the other references and argue that the circuits disclosed by the other references perform at the Penncock's asserted levels. The Examiner has made no effort to match elements of Penncock's switched capacitor digital-to-analog converter to the claimed elements, in light of the claim as a whole.

Applicant respectfully submits that claims 46 and 72 should be allowable over Ruha in view of Groves Jr. and Pennock.

CONCLUSION

Applicants respectfully submit that the pending claims are now in condition for allowance and thereby solicit acceptance of the claims, in light of these amendments.

If the Examiner has any questions with regard to this application, the undersigned can ordinarily be reached at his office at (650) 712-0340 from 8:30 to 5:30 PST, Monday through Friday, and can be reached at his cell phone at (415) 902-6112 most other times.

Respectfully submitted,

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